Xenon in Porous Vycor Glass*	X18A

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Recently a great deal of effort has been expended to study the effects of finite size and confinement on the properties of simple gases, liquids, and solids, achieved by adsorption into mesoporous materials, such as sol-gel glasses, porous Vycor glass, zeolites, and of course rocks and cements. To explore the effects of confinement on the structure of simple solids we have carried out x-ray diffraction measurements of xenon condensed and solidified in porous Vycor glass. The melting point of a 90/cell of confined xenon, marked by the disappearance of the (220) and (311) diffraction peaks, was found to be about 149 K as compared to 161.25 K in the bulk and the freezing point, as marked by the appearance of the above diffraction peaks (see Figure 1), was found to be about 141 K. Figure 2 shows the diffraction pattern of confined xenon at 110.6 K without the scattering from the Vycor and Be windows removed (solid line). Solid xenon at high temperatures is a disordered hexagonal close-packed structure (DHCP) indicated by the absence of the (200), (400), etc. reflections. At low temperatures these peaks appear, as well as sharp companions to the high temperature peaks (see Figure 2 dashed line), indicating the existence of some fcc solid. This solid-solid phase transition was also seen with argon and krypton (1) by our group and does not exist in the bulk phase diagram. The (200) peak is seen to disappear at about T = 106 K on warming. *Work supported by the Amer.Chem. Soc. Petroleum Research Fund, 31097-AC5 and U.S. DOE, No. DE-FG02-85ER45183.

(1) New Disorder Induced Phase Transitions of Classical Rare Gases in Porous Vycor Glass, D. W. Brown, P. E. Sokol, Penn. State Univ.; and S. N. Ehrlich, Purdue Univ.; Phys. Rev. Lett. 81 (5), 1019 (1998).

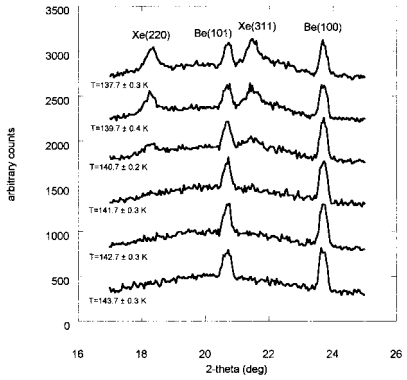

Figure 1. Diffraction pattern of xenon confined in porous Vycor glass at a set of temperatures on cooling. Appearance of Xe(220) and Xe(311) mark freezing point.

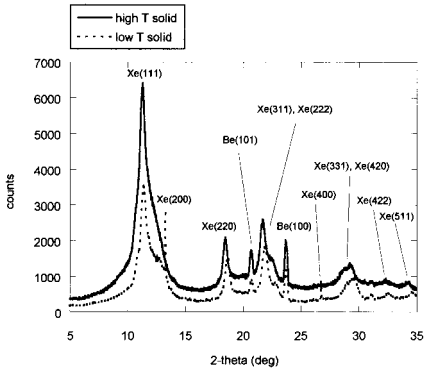

Figure 2. Diffraction pattern of solid xenon confined in porous Vycor glass in DHCP phase (T = 110.6 K) and low T phase (T = 39.15 K).